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(54) **METHOD AND DEVICE FOR CELL SWITCHING**

(57) A method and device for cell switching are disclosed. The method includes: according to the indication of a cell switching command sent by an access network equipment, a user equipment determines the subframe for uplink transmission in the cell switching process, herein the transmission direction of the subframe for uplink transmission in the cell switching process does not change in the cell switching process; in the process of switching to a target cell, the user equipment sends a message, which is used for switching to the target cell, to the access network equipment by using the determined subframe. In the embodiment of the invention, in the process of a UE handing over to a target cell, because the transmission direction of the subframe for uplink transmission does not change, the message, which is used for switching to the target cell and sent by the UE with the subframe. for uplink transmission, can be correctly received by the access network equipment, thereby the success ratio of a UE handing over to a target cell is improved.

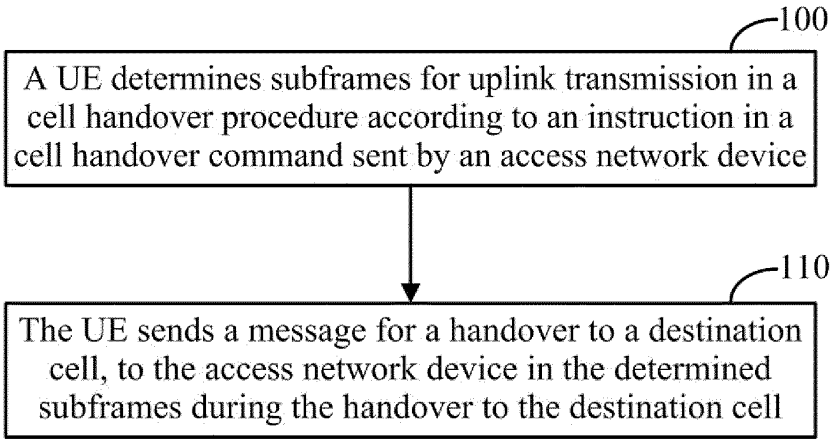

Fig.1

EP 2 986 054 A1

Description

[0001] This application claims the benefit of Chinese Patent Application No. 201310118038.4, filed with the State Intellectual Property Office of People's Republic of China on April 7, 2013 and entitled "Method and device for cell handover", which is hereby incorporated by reference in its entirety.

Field

[0002] The present invention relates to the field of communications and particularly to a method and device for cell handover.

Background

[0003] Seven Time Division Duplex (TDD) uplink-downlink (UL/DL) configurations as depicted in Table 1 are defined in total in a Long Term Evolution (LTE) TDD system. In the seven TDD UL/DL configurations, the subframe 0 and the subframe 5, and a Downlink Pilot Slot (DwPTS) in a special subframe in a radio frame are always used for downlink transmission; and the subframe 2, and an Uplink Pilot Slot (UpPTS) in the special subframe in the radio frame are always used for uplink transmission.

Table 1 LTE TDD UL/DL configurations

Configuration No.	Subframe No.									
	0	1	2	3	4	5	6	7	8	9
0	D	S	U	U	U	D	S	U	U	U
1	D	S	U	U	D	D	S	U	U	D
2	D	S	U	D	D	D	S	U	D	D
3	D	S	U	U	U	D	D	D	D	D
4	D	S	U	U	D	D	D	D	D	D
5	D	S	U	D	D	D	D	D	D	D
6	D	S	U	U	U	D	S	U	U	D

[0004] Here D represents a downlink subframe, U represents an uplink subframe, and S represents a special subframe.

[0005] The TDD UL/DL configuration schemes in the LTE Release 8 (R8) are static or semi-static. The static or semi-static TDD UL/DL configurations are applicable to a scenario of large coverage by a macro cell. However an increasing number of cells covered by low-power base stations including picocells, home NodeBs, etc., have been deployed for small coverage areas along with the advancement of technologies, and there are a small number of User Equipments (UEs) and a significantly varying traffic demand of the UEs in these cells, thus resulting in a dynamically varying proportion of uplink traffic to downlink traffic being needed in the cells. In view of this, the dynamic TDD UL/DL configuration change mechanism has been introduced to the project of Enhancement to LTE TDD for DL-UL Interference Management and Traffic Adaptation (LTE eIMTA) so that the TDD UL/DL configuration change frequency shortens from several days to several milliseconds (ms). If the TDD UL/DL configuration is changed, then the eNB will notify the UE, where the existing notification mechanisms include a broadcast scheme, a dedicated signaling scheme, etc.

[0006] Particularly in the broadcast scheme, the change can be notified of via a system message update or similarly to an Earthquake and Tsunami Warning System (ETWS). The TDD UL/DL configuration change periodicity allowable by the system message update is 640 ms, and the TDD UL/DL configuration change periodicity allowable by the ETWS-like notification is 320 ms. Furthermore the broadcast scheme can be categorized into the following three categories:

[0007] 1. A TDD UL/DL configuration notification Information Element (IE) is introduced to a Master Information Block (MIB), and the User Equipment (UE) is notified of the updated TDD UL/DL configuration in the MIB, so that the UE is forced to fetch the MIB at least once in several ms, which can be the TDD UL/DL configuration update periodicity.

[0008] 2. The R8 system message update procedure is reused to notify the UE of the updated TDD UL/DL configuration.

[0009] 3. The R10 ETWS notification procedure is reused, that is, firstly the UE is notified via paging that the TDD UL/DL configuration is changed, and then the UE obtains the updated TDD UL/DL configuration by fetching a System Information Block 1 (SIB1), or a TDD UL/DL configuration indicator newly defined in a new System Information Block (SIB).

[0010] Particularly the dedicated signaling scheme can adopt Radio Resource Control (RRC) signaling, Media Access

Control (MAC) signaling, or Physical Downlink Control Channel (PDCCH) signaling. The TDD UL/DL configuration change periodicity allowed for RRC signaling is approximately 200 ms; the TDD UL/DL configuration change periodicity allowed for MAC signaling is approximately tens of ms; and the TDD UL/DL configuration change periodicity allowed for PDCCH signaling is approximately 10 ms.

[0011] If the UE needs cell handover, then the UE obtains a TDD UL/DL configuration of a destination cell in a cell handover command, and selects according to the configuration a resource to initiate a random access for a random access procedure. In the dynamic TDD UL/DL configuration scenario, the TDD UL/DL configuration of the destination cell may change after a destination eNB sends out a random access response message as the cell handover command (where the message carries the TDD UL/DL configuration of the destination cell), so that the TDD UL/DL configuration of the destination cell, obtained by the UE from the cell handover command will be different from the TDD UL/DL configuration really used by the destination cell, thus resulting in such a failure of the random access procedure that the UE may fail to be handed over to the destination cell.

Summary

[0012] An object of the invention is to provide a method and device for cell handover so as to address such a problem that the UE may fail to be handed over to the destination cell since a TDD UL/DL configuration of a destination cell may change after a destination eNB sends out a response message to a cell handover request.

[0013] The object of the invention is attained in the following technical solutions:

[0014] A first method for cell handover includes:

determining, by a UE, subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

sending a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0015] A second method for cell handover includes:

determining, by an access network device, subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

sending, by the access network device, a cell handover command to the UE, wherein the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0016] A first UE includes:

an uplink transmission subframe determining unit configured to determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

a handover unit configured to send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0017] A first access network device includes:

an uplink transmission subframe determining unit configured to determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and
a handover command sending unit configured to send a cell handover command to the UE, wherein the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0018] In the embodiments of the invention, the transmission directions of the subframes for uplink transmission remain

unchanged in the cell handover procedure of the UE to the destination cell, so that the message for the handover to the destination cell, sent by the UE in the subframes for uplink transmission can be received correctly by the access network device during the handover to the destination cell to thereby improve the handover success ratio of the UE to the destination cell.

[0019] A third method for cell handover includes:

detecting, by a UE, a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the UE, then determining subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

sending, by the UE, a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0020] A fourth method for cell handover includes:

determining, by an access network device, that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and

sending, by the access network device, a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

[0021] A second UE includes:

a broadcast detecting unit configured to detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

an uplink transmission subframe determining unit configured, if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the broadcast detecting unit, to determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

a handover unit configured to send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0022] A second access network device includes:

a cell type determining unit configured to determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and

a handover command sending unit configured to send a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

[0023] A third UE includes a processor and a memory, where the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0024] A fourth UE includes a processor and a memory, where the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the processor, determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0025] A third access network device includes a processor and a memory, where the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

send a cell handover command to the UE, wherein the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0026] A fourth access network device includes a processor and a memory, where the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and

send a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

[0027] In the embodiments of the invention, the access network device sends the cell handover command carrying the cell type information to the UE to indicate that the destination cell supports a dynamic TDD UL/DL configuration. The UE detects a broadcast of the access network device upon determining that the destination cell supports a dynamic TDD UL/DL configuration. If the TDD UL/DL configuration of the destination cell is changed, then the UE can know it in a timely manner, and determine the subframes for uplink transmission according to the changed TDD UL/DL configuration, so that the message for a handover to the destination cell, sent by the UE in the subframes for uplink transmission can be received correctly by the access network device during the handover to the destination cell to thereby improve the handover success ratio of the UE to the destination cell.

Brief Description of the Drawings

[0028]

Fig.1 illustrates a flow chart of a first method at the UE side according to an embodiment of the invention;
Fig.2 illustrates a flow chart of a second method at the UE side according to an embodiment of the invention;
Fig.3 illustrates a flow chart of a first method at the access network device side according to an embodiment of the invention;
Fig.4 illustrates a flow chart of a second method at the access network device side according to an embodiment of the invention;
Fig.5 illustrates a diagram of signaling interaction in a contention based random access;
Fig.6 illustrates a diagram of signaling interaction in a non-contention based random access;
Fig.7 illustrates a schematic structural diagram of a first UE according to an embodiment of the invention;
Fig.8 illustrates a schematic structural diagram of a second UE according to an embodiment of the invention;
Fig.9 illustrates a schematic structural diagram of a third UE according to an embodiment of the invention;
Fig.10 illustrates a schematic structural diagram of a fourth UE according to an embodiment of the invention;

Fig.11 illustrates a schematic structural diagram of a first access network device according to an embodiment of the invention;

Fig.12 illustrates a schematic structural diagram of a second access network device according to an embodiment of the invention;

Fig.13 illustrates a schematic structural diagram of a third access network device according to an embodiment of the invention; and

Fig.14 illustrates a schematic structural diagram of a fourth access network device according to an embodiment of the invention.

Detailed Description of the Embodiments

[0029] Embodiments of the invention provide a solution to cell handover. In this solution, an access network device determines subframes for uplink transmission in a cell handover procedure of the UE to a destination cell, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and the access network device sends a cell handover command to the UE, where the cell handover command carries information instructing the UE to determine the subframes for uplink transmission in the cell handover procedure. The UE determines the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device; and the UE sends a message for cell handover to the destination cell, to the access network device in the determined subframes in the cell handover procedure to the destination cell.

[0030] In the embodiments of the invention, the transmission directions of the subframes for uplink transmission remain unchanged in the cell handover procedure of the UE to the destination cell, so that the message for cell handover to the destination cell, sent by the UE in the subframes for uplink transmission can be received correctly by the access network device during the cell handover to the destination cell to thereby improve the handover success ratio of the UE to the destination cell.

[0031] The embodiments of the invention further provide another solution to cell handover. In the solution, an access network device determines that a destination cell supports a dynamic TDD UL/DL configuration, and sends a cell handover command to a UE, where the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic TDD UL/DL configuration. The UE detects a broadcast of the access network device upon determining that the destination cell supports a dynamic TDD UL/DL configuration, according to the cell type information of the destination cell, carried in the cell handover command sent by the access network device; and if a broadcast carrying a changed TDD UL/DL configuration of the destination cell is detected by the UE, then the UE determines subframes for uplink transmission in a cell handover procedure according to the changed TDD UL/DL configuration; and the UE sends a message for cell handover to the destination cell, to the access network device in the determined subframes in the cell handover to the destination cell.

[0032] In the embodiments of the invention, the access network device sends the cell handover command carrying the cell type information to the UE to indicate that the destination cell supports a dynamic TDD UL/DL configuration. The UE detects a broadcast of the access network device upon determining that the destination cell supports a dynamic TDD UL/DL configuration. If the TDD UL/DL configuration of the destination cell is changed, then the UE can know it in a timely manner, and determine the subframes for uplink transmission according to the changed TDD UL/DL configuration, so that the message for a handover to the destination cell, sent by the UE in the subframes for uplink transmission can be received correctly by the access network device during the handover to the destination cell to thereby improve the handover success ratio of the UE to the destination cell.

[0033] In the embodiments of the invention, if a source cell and the destination cell are served by the same eNB, then the access network device is the eNB. If the source cell and the destination cell are served by different eNBs, then the access network device includes a source eNB and a destination eNB.

[0034] The technical solutions according to the embodiments of the invention will be described below in details with reference to the drawings.

[0035] Fig.1 illustrates a flow chart of a method at the UE side of the solution to cell handover according to an embodiment of the invention, where a particular implementation thereof includes:

In the step 100, a UE determines subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device.

[0036] In the embodiment of the invention, transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure. The subframes for uplink transmission can be uplink subframes or can be UpPTSs in special subframes.

[0037] The subframes for which the transmission directions remain unchanged in the cell handover procedure can be

subframes with the same transmission direction in a set of TDD UL/DL configurations (which can be but will not be limited to that depicted in Table 1) in a communication system, or can be subframes for which transmission directions do not varying with a varying TDD UL/DL configuration in the cell handover procedure and even a period of time after cell handover is completed.

[0038] If a source cell and a destination cell are served by different eNBs, then the cell handover command received by the UE is sent by a source eNB.

[0039] In the step 110, the UE sends a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0040] If a source cell and the destination cell are served by different eNBs, then the UE sends the message for cell handover to the destination cell to a destination eNB in the cell handover procedure. For example, the UE sends a preamble to the destination eNB as a random access request, sends a cell handover completion message to the destination eNB, etc.

[0041] In the embodiment of the invention, the UE can determine the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device in a number of implementations, several of which will be listed below.

In a first implementation in which the UE determines the subframes for uplink transmission in the cell handover procedure:

[0042] The UE obtains Physical Random Access Channel (PRACH) configuration information carried in the cell handover command, determines subframes for transmitting a PRACH according to the PRACH configuration information, and determines the subframes for transmitting a PRACH as the subframes for uplink transmission in the cell handover procedure.

[0043] Here the PRACH configuration information can include but will not be limited to a PRACH configuration index (prach-ConfigIndex). The prach-ConfigIndex corresponds to subframes in an LTE system. For example, prach-ConfigIndex ranging from 48 to 53 is transmitted in the subframe 2, and an UpPTS in a special subframe.

[0044] In a second implementation in which the UE determines the subframes for uplink transmission in the cell handover procedure:

[0045] The UE obtains subframe numbers for uplink transmission, carried in the cell handover command, and determines subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

[0046] Here the cell handover command carries the subframe numbers for uplink transmission. The cell handover command can also cany subframe numbers, and the UE can determine as prescribed the subframes corresponding to the subframe numbers carried in the cell handover command as the subframe number for uplink transmission in the cell handover procedure.

[0047] Further to any one of the embodiments of the method at the UE side in Fig.1, preferably the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure. Transmission directions of the subframe numbers for downlink transmission in the cell handover procedure remain unchanged in the cell handover procedure. The UE obtains the subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and the UE detects scheduling information sent by the access network device, in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

[0048] In a third implementation in which the UE determines the subframes for uplink transmission in the cell handover procedure:

The UE obtains a TDD UL/DL configuration for the cell handover procedure, carried in the cell handover command, and determines the subframes for uplink transmission in the cell handover procedure according to the TDD UL/DL configuration carried in the cell handover command.

[0049] In this implementation, the UE can further determine subframes for downlink transmission in the cell handover procedure according to the TDD UL/DL configuration carried in the cell handover command; and the UE detects scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

[0050] In a fourth implementation in which the UE determines the subframes for uplink transmission in the cell handover procedure:

The UE determines subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic

TDD UL/DL configuration, according to cell type information of the destination cell, carried in the cell handover command, where the cell type information indicates that whether the cell supports a dynamic TDD UL/DL configuration, or the cell type information indicates that the destination cell supports a dynamic TDD UL/DL configuration.

[0051] In this fourth implementation, preferably the UE can search pre-configuration information for the subframes for uplink transmission and with unchanged transmission directions. The UE can alternatively obtain the subframes for uplink transmission and with unchanged transmission directions via higher-layer signaling. Particularly the UE can obtain the subframes for uplink transmission and with unchanged transmission directions via the higher-layer signaling before the cell handover procedure, or can obtain the subframes for uplink transmission and with unchanged transmission directions via the higher-layer signaling in the cell handover procedure.

[0052] In this fourth implementation, the subframes for uplink transmission and with unchanged transmission directions can be subframes with the same transmission direction in a set of TDD UL/DL configurations (as depicted in Table 1) in the communication system, or can be subframes for uplink transmission and with unchanged transmission directions, which are preconfigured or are indicated in higher-layer signaling (e.g., the subframe 1, the subframe 2, the subframe 6, and the subframe 7 in the set of configurations (0, 1, 2, 6) in Table 1).

[0053] Further to any one of the embodiments of the method at the UE side in Fig.1, preferably the UE starts to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response in the cell process to the destination cell. In the embodiment o the invention, the length of the random access response window is an integer greater than 10 ms, e.g., 12 ms, 14 ms, 15 ms, 20 ms, etc.

[0054] Since the TDD UL/DL configuration is changed, there may be a small number of subframes for downlink transmission, so if the random access response window lengthens, then the success ratio of the random access will be improved.

[0055] Fig.2 illustrates a flow chart of another method at the UE side in the solution to cell handover according to an embodiment of the invention, where an implementation thereof includes:

In the step 200, a UE detects a broadcast of an access network device upon determining that a destination cell supports a dynamic TDD UL/DL configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

[0056] In the step 210, if a broadcast carrying a changed TDD UL/DL configuration of the destination cell is detected by the UE, then the UE determines subframes for uplink transmission in a cell handover procedure according to the changed TDD UL/DL configuration; and

[0057] In the step 220, the UE sends a message for a handover to the destination cell, to the access network device in the subframes for uplink transmission in the cell handover procedure, determined according to the changed TDD UL/DL configuration, during the handover to the destination cell.

[0058] Here if the UE does not detect the broadcast carrying a changed TDD UL/DL configuration of the destination cell, then the UE sends the message for a handover to the destination cell, to the access network device according to a TDD UL/DL configuration of the destination cell, carried in the cell handover command, during the handover to the destination cell.

[0059] Fig.3 illustrates a flow chart of a method for cell handover at the access network device side according to an embodiment of the invention, where a particular implementation thereof includes:

In the step 300, an access network device determines subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure.

[0060] Here the access network device can determine uplink subframes and special subframes (particularly UpPTSs in the special subtirames) with the same transmission direction in a set of TDD UL/DL configurations (as depicted in Table 1) in a communication system as the subframes for uplink transmission in the cell handover procedure, or can determine uplink subframes and special subframes with the same transmission direction in a part of the TDD UL/DL configurations in the set of TDD UL/DL configurations (as depicted in Table 1) in the communication system as the subframes for uplink transmission in the cell handover procedure, e.g., the subframe 1, the subframe 2, the subframe 6, and the subframe 7 in the configurations (0, 1, 2, 6).

[0061] In the step 310, the access network device sends a cell handover command to the UE, where the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0062] In the embodiment of the invention, there are a number of instances of the information carried in the cell

handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure, several of which will be listed below.

[0063] First information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is PRACH configuration information.

[0064] Correspondingly the access network device selects subframes for transmitting a PRACH from subframes for uplink transmission and with unchanged transmission directions, and determines the subframes for transmitting a PRACH as the subframes for uplink transmission in the cell handover procedure. The access network device generates the PRACH configuration information corresponding to the subframes for transmitting a PRACH before the cell handover command is sent to the UE.

[0065] Second information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission.

[0066] Correspondingly the access network device determines subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure.

[0067] Correspondingly the access network device can further receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0068] Third information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a TDD UL/DL configuration in the cell handover procedure.

[0069] Correspondingly the access network device can further receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0070] Based upon the third information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure, the access network device can further determine subframes for downlink transmission in the cell handover procedure according to the TDD UL/DL configuration in the cell handover procedure; and the access network device can send scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

[0071] Further to any one of the embodiments of the method at the access network device side in Fig.3, preferably after a cell handover completion message sent by the UE is received, if a TDD UL/DL configuration of the destination cell is changed in the cell handover procedure, then the access network device sends the changed TDD UL/DL configuration to the UE; and if the TDD UL/DL configuration of the destination cell in the cell handover procedures is not changed, then the access network device sends the TDD UL/DL configuration of the destination cell, or indication information that the TDD UL/DL configuration is not changed to the UE. Alternatively the access network device can further send the TDD UL/DL configuration of the destination cell to the UE upon reception of the cell handover completion message sent by the UE, no matter whether the TDD UL/DL configuration of the destination cell is changed.

[0072] Further to any one of the embodiments of the method at the access network device side in Fig.3, preferably the access network device sends a random access response message to the UE in a random access response window at a starting instance of time of a random access response, where the length of the random access response window is an integer greater than 10 ms.

[0073] Further to any one of the embodiments of the method at the access network device side in Fig.3, preferably the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the access network device can further send scheduling information to the UE in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell, where transmission directions of the subframes for downlink transmission in the cell handover procedure remain unchanged in the cell handover procedure. Particularly the access network device can determine downlink subframes and special subframes (particularly DwPTS in the special subframes) with the same transmission direction in the set of TDD UL/DL configurations (as depicted in Table 1) in the communication system as the subframes for uplink transmission in the cell handover procedure, or can determine downlink subframes and/or special subframes with the same transmission direction in a part of the TDD UL/DL configurations in the set of TDD UL/DL configurations (as depicted in Table 1) in the communication system as the subframes for downlink transmission in the cell handover procedure, e.g., the subframe 0, the subframe 1, and the subframes 5 to 9 in the configurations (3, 4, 5).

[0074] Fig.4 illustrates a flow chart of another method for cell handover at the access network device side according to an embodiment of the invention, where a particular implementation thereof includes:

[0075] In the step 400, an access network device determines that a destination cell supports a dynamic TDD UL/DL configuration.

[0076] In the step 410, the access network device sends a cell handover command to the UE, where the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic TDD UL/DL configuration.

[0077] The technical solutions according to the embodiments of the invention will be described below in details by way of an example in which a UE is handed over from a cell of a macro eNB to a small cell of a local eNB in a heterogeneous network. Then the access network device as referred to in the invention includes a local eNB which is a source eNB,

and a local eNB which is a destination eNB.

[0078] After the local eNB determines that the UE is allowed to be handed over to the destination cell served by the local eNB, the UE will initiate a random access procedure to the local eNB to be synchronized to the destination cell, where either a contention based random access or a non-contention based random access can be initiated.

[0079] Firstly a contention based random access and a non-contention based random access will be described below respectively.

[0080] Fig.5 illustrates a contention based random access procedure particularly including the following operations:

In the step 500, the UE sends an Msg1 to the eNB, where the Msg1 carries a preamble for a random access.

[0081] Particularly the UE selects the preamble and a PRACH for transmitting the preamble from a set of preambles, and a set of PRACH channel resources for transmitting preambles, allocated by the eNB in advance for the UE, and sends the preamble over the PRACH.

[0082] In the step 510, the eNB sends an Msg2, i.e., a Random Access Response (RAR) message, to the UE.

[0083] The message is a response of the eNB to the UE upon reception of the Msg1, and the random access response message shall be sent in a random access response window. A starting instance of time of the window is spaced by 2 ms from an ending instance of time of transmission of the preamble, and a particular configured length thereof is specified and notified by the eNB to the UE.

[0084] In the step 520, the UE sends an Msg3 to the eNB for scheduled transmission.

[0085] The UE transmits the Msg3 over an uplink resource allocated in the Msg2 upon correction reception of the Msg2. The Msg3 can be transmitted in an HARQ procedure.

[0086] In the step 530, the eNB returns an Msg4 to the UE for contention resolving.

[0087] The Msg4 is configured to resolve potential contention to determine the particular UE to complete the current random access procedure. The UE starts a contention resolving timer when the Msg3 is sent, and restarts the timer each time the Msg3 is retransmitted. The contents of the Msg4 correspond to the contents of the Msg3.

[0088] Fig.6 illustrates a non-contention based random access procedure particularly including the following operations:

In the step 600, the eNB sends an Msg0, i.e., a random access instruction message, to the UE.

[0089] The contents of the Msg0 include a PRACH resource and a preamble resource over which the UE initiates a non-contention based random access.

[0090] In the step 610, the UE sends an Msg1 carrying the preamble to the eNB.

[0091] The sent preamble has been allocated and indicated by the eNB, so the UE will not select any set of preambles or preamble. If the eNB does not indicate a set of PRACH channels available, then the UE will select the PRACH channel for transmitting a preamble from the preconfigured set of PRACH channels; and if the eNB indicates a set of PRACH resources in the Msg0, then the UE will select the PRACH channel in the indicated set of PRACH channels, and send the specified preamble over the selected RPACH channel.

[0092] In the step 620, the eNB sends a Random Access Response (RAR) message to the UE.

[0093] The message is a response of the eNB to the UE upon reception of the Msg1, and the random access response message shall be sent in a random access response window. A starting instance of time of the window is spaced by 2 ms from an ending instance of time of transmission of the preamble, and a particular configured length thereof is specified and notified by the eNB to the UE.

[0094] The UE can be handed over to the destination cell served by the local eNB (the destination cell supports a dynamic TDD UL/DL configuration) according to an embodiment of the invention in the application scenario of the heterogeneous network in a particular implementation as follows:

[0095] The macro eNB sends a cell handover request message including cell handover preparation information to the local eNB upon determining from a cell handover measurement report that a cell handover procedure of the UE needs to be performed. The cell handover preparation information assists the destination eNB in admission control to configure an RB, a radio resource, etc. The local eNB makes an admission decision according to QoS information of the bearer, a load, interference, etc., upon reception of the cell handover request message, and configures the bearer, the radio resource, etc., according to the cell handover preparation information upon deciding that the UE is allowed to be admitted, and sends a response message to the cell handover request to the macro eNB upon successful configuration.

[0096] Here the local eNB configures the bearer by selecting subframes for transmitting a PRACH (i.e., the subframe 2 and the UpPTS in the subframe 1) from the subframes for uplink transmission and with the same transmission direction in Table 1, carrying PRACH configuration information corresponding to the subframes in the response message to the cell handover request, and sending it to the macro eNB, where the PRACH configuration information corresponding to the subframe 2 and the UpPTS in the subframe 1 can be prach-ConfigIndex ranging from 48 to 53.

[0097] The local eNB returns the response message to the cell handover request to the macro eNB as the cell handover

command to trigger a cell handover of the UE, and the macro eNB sends the received cell handover command to the UE in an RRC connection reconfiguration message carrying the cell handover command, and stops data of the UE from being transmitted and received with the present eNB.

[0098] The UE stops data from being transmitted and received with the macro eNB, and initiates a random access procedure to the local NB to be synchronized with the destination cell in the uplink and the downlink, upon reception of the cell handover command sent by the macro eNB. The random access procedure can be the contention based random access illustrated in Fig.5 or can be the non-contention based random access illustrated in Fig.6. In the random access procedure, the UE selects the available PRACH resource according to prach-ConfigIndex in the cell handover command, and sends the preamble over the selected PRACH channel. If the UE sends the preamble in the subframe n, then the UE will start to receive the random access response message sent by the local eNB, in the subframe n+3 in the random access response window (RAR window). Particularly the range of values in the RAR window can be extended to an integer number of milliseconds greater than 10 ms, e.g., 12 ms, 14 ms, 15 ms, 20 ms, etc. The UE decoding the random access response message successfully feeds the cell handover completion message (i.e., the RRC reconfiguration completion message) back to the local eNB only in the subframes configured with a PRACH to notify the local eNB that cell handover has been completed. If the random access procedure is the contention based random access procedure, then the UE will send the Msg3 to the local eNB in the subframes configured with a PRACH.

[0099] Optionally after the local eNB receives the cell handover completion message, if the TDD UL/DL configuration of the destination cell is changed in the cell handover procedure of the UE, then the local eNB will notify the UE of the changed TDD UL/DL configuration of the destination cell; otherwise, the local eNB will send the indication information that the TDD UL/DL configuration is not changed in the cell handover procedure, or the TDD UL/DL configuration of the destination cell to the UE. Alternatively the local eNB can send the TDD UL/DL configuration of the destination cell to the UE upon reception of the cell handover completion message sent by the UE.

[0100] For example, the destination cell is currently configured with the TDD UL/DL configuration 1, and after the destination eNB replies with the response message to the cell handover request, the TDD UL/DL configuration of the destination cell is changed to the configuration 3, and the subframe 2 and the subframe 1 (special subframes) are subframes for uplink transmission and with transmission directions which do not vary with a varying TDD UL/DL configuration. According to the subframe 1 and the subframe 2, the destination eNB selects the PRACH configuration resources (e.g., prach-ConfigIndex=48) which can be selected by the UE during the handover to the destination cell to be carried in the subframe 1 and the subframe 2, and notifies the UE of the PRACH configuration information. The UE determines the available uplink transmission subframes from prach-ConfigIndex=48, and performs the random access procedure in the determined uplink transmission subframes.

[0101] The UE can be handed over to the destination cell served by the local eNB (the destination cell supports a dynamic TDD UL/DL configuration) according to another embodiment of the invention in the application scenario of the heterogeneous network in a particular implementation as follows:

The macro eNB sends a cell handover request message including cell handover preparation information to the local eNB upon determining from a cell handover measurement report that a cell handover procedure of the UE needs to be performed. The cell handover preparation information assists the destination eNB in admission control to configure an RB, a radio resource, etc. The local eNB makes an admission decision according to QoS information of the bearer, a load, interference, etc., upon reception of the cell handover request message, and configures the bearer, the radio resource, etc., according to the cell handover preparation information upon deciding that the UE is allowed to be admitted, and sends a response message to the cell handover request to the macro eNB upon successful configuration.

[0102] Here the local eNB configures the bearer by determining the subframes for uplink transmission in the cell handover procedure. Particularly subframes for uplink transmission and with the same transmission direction in the respective configurations in Table 1 can be determined as the subframes for uplink transmission in the cell handover procedure; or subframes for uplink transmission and with the same transmission direction in a part of the configurations in Table 1 can be determined as the subframes for uplink transmission in the cell handover procedure.

[0103] Furthermore the local eNB can carry the subframe numbers for uplink transmission in the response message to the cell handover request and send it to the macro eNB, or can select and carry a TDD UL/DL configuration corresponding to the subframes for uplink transmission in the cell handover procedure (which can be a new TDD UL/DL configuration) in the response message to the cell handover request and send it to the macro eNB.

[0104] If the subframe numbers for uplink transmission are carried in the response message to the cell handover request and sent to the macro eNB, then optionally subframes for downlink transmission and with the same transmission direction in the respective configurations in Table 1 can be determined as the subframes for downlink transmission in the cell handover procedure; or subframes for downlink transmission and with the same transmission direction in a part of the configurations in Table 1 can be determined as the subframes for downlink transmission in the cell handover

procedure. The subframe numbers for downlink transmission in the cell handover procedure can be carried in the response message to the cell handover request and sent to the macro eNB.

[0105] It shall be noted that the determined subframes for uplink transmission or downlink transmission in the cell handover procedure may not necessarily be uplink subframes or downlink subframes indicated in the TDD UL/DL configuration currently used by the destination cell. The local eNB performs the random access procedure with the UE in the determined subframes for uplink transmission or downlink transmission in the cell handover procedure, in the cell handover procedure, but still communicates with other UEs in the current TDD UL/DL configuration of the destination cell, in the destination cell.

[0106] It shall be noted that the macro eNB can alternatively determine the subframes for uplink transmission or the subframes for downlink transmission in the cell handover procedure, and send the subframe numbers of the determined subframes for uplink transmission or subframes for downlink transmission in the cell handover procedure, or a TDD UL/DL configuration including the subframes for uplink transmission or the subframes for downlink transmission in the cell handover procedure to the UE and the local eNB, and the UE and the local eNB perform the random access procedure in the indicated subframes for uplink transmission or subframes for downlink transmission in the cell handover procedure. Correspondingly in order to enable the macro eNB to know that the destination cell supports a dynamic TDD UL/DL configuration, this can be signaled by the local eNB or can be notified by an OAM.

[0107] The local eNB returns the response message to the cell handover request to the macro eNB as the cell handover command to trigger the cell handover of the UE, and the macro eNB sends the received cell handover command to the UE in an RRC connection reconfiguration message carrying the cell handover command, and stops data of the UE from being transmitted and received with the present eNB.

[0108] The UE stops data from being transmitted and received with the macro eNB, and initiates a random access procedure to the local NB to be synchronized with the destination cell in the uplink and the downlink, upon reception of the cell handover command sent by the macro eNB. The random access procedure can be the contention based random access illustrated in Fig.5 or can be the non-contention based random access illustrated in Fig.6. In the random access procedure, the UE selects the available PRACH resource in the subframes for uplink transmission, indicated in the cell handover command, and sends the preamble over the selected PRACH channel. If the UE sends the preamble in the subframe n, then the UE will start to receive the random access response message sent by the local eNB, in the subframe n+3 in the random access response window (RAR window). Particularly the range of values in the RAR window can be extended to an integer number of milliseconds greater than 10 ms, e.g., 12 ms, 14 ms, 15 ms, 20 ms, etc. The UE decoding the random access response message successfully feeds the cell handover completion message (i.e., the RRC reconfiguration completion message) back to the local eNB only in the subframes for uplink transmission, indicated in the cell handover command, to notify the local eNB that cell handover has been completed. If the random access procedure is the contention based random access procedure, then the UE will send the Msg3 to the local eNB in the subframes for uplink transmission, indicated in the cell handover command.

[0109] Optionally the UE receives a downlink message in the cell handover procedure, e.g., scheduling information sent by the local eNB, in the subframes for downlink transmission, indicated in the cell handover command.

[0110] Optionally after the local eNB receives the cell handover completion message, if the TDD UL/DL configuration of the destination cell is changed in the cell handover procedure of the UE, then the local eNB will notify the UE of the changed TDD UL/DL configuration of the destination cell; otherwise, the local eNB will send the indication information that the TDD UL/DL configuration is not changed in the cell handover procedure, or the TDD UL/DL configuration of the destination cell to the UE. Alternatively the local eNB can send the TDD UL/DL configuration of the destination cell to the UE upon reception of the cell handover completion message sent by the UE.

[0111] For example, the destination cell is currently configured with the TDD UL/DL configuration 1, and after the destination eNB replies with the response message to the cell handover request, the TDD UL/DL configuration of the destination cell is changed to the configuration 3, and the subframe 2 and the subframe 1 (special subframes) are subframes for uplink transmission and with transmission directions which do not vary with a varying TDD UL/DL configuration. The destination eNB notifies the UE in the response message to the cell handover request that the subframe 1 and the subframe 2 are the subframes for uplink transmission in the cell handover procedure (furthermore the destination eNB can notify the UE that the subframes 0, 1, 5 and 6 can be used for DL transmission so that the UE will detects these subframes for a PDCCH). The UE knows the subframes for uplink transmission/downlink transmission in the cell handover procedure, notified of by the eNB side in the RRC reconfiguration message carrying the cell handover command, and performs uplink transmission in the random access procedure in the subframes 1 and 2 as notified of by the eNB in the cell handover procedure (furthermore the UE can receive PDCCH scheduling only in the subframes 0, 1, 5 and 6).

[0112] The UE can be handed over to the destination cell served by the local eNB (the destination cell supports a dynamic TDD UL/DL configuration) according to another embodiment of the invention in the application scenario of the heterogeneous network in a particular implementation as follows:

The macro eNB sends a cell handover request message including cell handover preparation information to the local

eNB upon determining from a cell handover measurement report that a cell handover procedure of the UE needs to be performed. The cell handover preparation information assists the destination eNB in admission control to configure an RB, a radio resource, etc. The local eNB makes an admission decision according to QoS information of the bearer, a load, interference, etc., upon reception of the cell handover request message, and configures the bearer, the radio resource, etc., according to the cell handover preparation information upon deciding that the UE is allowed to be admitted, and sends a response message to the cell handover request to the macro eNB upon successful configuration.

[0113] Here the local eNB carries cell type information in the response message to the cell handover request to indicate that the destination cell supports a dynamic TDD UL/DL configuration.

[0114] The local eNB returns the response message to the cell handover request to the macro eNB as the cell handover command to trigger the handover of the UE, and the macro eNB sends the received cell handover command to the UE in an RRC connection reconfiguration message carrying the cell handover command, and stops data of the UE from being transmitted and received with the present eNB.

[0115] The UE stops data from being transmitted and received with the macro eNB, and initiates a random access procedure to the local NB to be synchronized with the destination cell in the uplink and the downlink, upon reception of the cell handover command sent by the macro eNB. The random access procedure can be the contention based random access illustrated in Fig.5 or can be the non-contention based random access illustrated in Fig.6. After the UE knows that the destination cell supports a dynamic TDD UL/DL configuration, in the random access procedure, the UE selects the PRACH resource in the subframes for uplink transmission in the respective configurations in Table 1, and sends the preamble over the selected PRACH channel. If the UE sends the preamble in the subframe n, then the UE will start to receive the random access response message sent by the local eNB, in the subframe n+3 in the random access response window (RAR window). Particularly the range of values in the RAR window can be extended to an integer number of milliseconds greater than 10 ms, e.g., 12 ms, 14 ms, 15 ms, 20 ms, etc. The UE decoding the random access response message successfully feeds the cell handover completion message (i.e., the RRC reconfiguration completion message) back to the local eNB only in the subframes for uplink transmission in the respective configurations in Table 1, to notify the local eNB that cell handover has been completed. If the random access procedure is the contention based random access procedure, then the UE will send the Msg3 to the local eNB in the subframes for uplink transmission in the respective configurations in Table 1.

[0116] Correspondingly the local eNB receives a message sent by the UE in the subframes for uplink transmission in the respective configurations in Table 1.

[0117] Optionally after the local eNB receives the cell handover completion message, if the TDD UL/DL configuration of the destination cell is changed in the cell handover procedure of the UE, then the local eNB will notify the UE of the changed TDD UL/DL configuration of the destination cell; otherwise, the local eNB will send the indication information that the TDD UL/DL configuration is not changed in the cell handover procedure, or the TDD UL/DL configuration of the destination cell to the UE. Alternatively the local eNB can send the TDD UL/DL configuration of the destination cell to the UE upon reception of the cell handover completion message sent by the UE.

[0118] Particularly if the TDD UL/DL configuration change is notified of via system information as specified for a system information change in the Release 8 (R8), then the cell handover command will further carry the TDD UL/DL configuration to be updated (e.g., the configuration 3), and an instance of time when it is updated. The UE operates in the updated TDD UL/DL configuration (e.g., the configuration) at the instance of time when the TDD configuration is updated, as notified of, but operates in the current TDD UL/DL configuration (e.g., the configuration 1) of the destination cell before the instance of time when the configuration is updated arrives.

[0119] For example, the destination cell is currently configured with the TDD UL/DL configuration 1, and after the destination eNB replies with the response message to the cell handover request, the TDD UL/DL configuration of the destination cell is changed to the configuration 3, and the subframe 1 and the subframe 2 are subframes for uplink transmission and with unchanged transmission directions. The destination eNB notifies the UE in the response message to the cell handover request that the destination cell of cell handover is the type of cell supporting a dynamic TDD UL/DL configuration. The UE performs uplink transmission of the random access only in the subframe 1 and the subframe 2 upon knowing from the RRC reconfiguration message carrying the cell handover command that the handover destination cell is a cell supporting a dynamic TDD UL/DL configuration.

[0120] The UE can be handed over to the destination cell served by the local eNB (the destination cell supports a dynamic TDD UL/DL configuration) according to another embodiment of the invention in the application scenario of the heterogeneous network in a particular implementation as follows:

The macro eNB sends a cell handover request message including cell handover preparation information to the local eNB upon determining from a cell handover measurement report that a cell handover procedure of the UE needs to be performed. The cell handover preparation information assists the destination eNB in admission control to

configure an RB, a radio resource, etc. The local eNB makes an admission decision according to QoS information of the bearer, a load, interference, etc., upon reception of the cell handover request message, and configures the bearer, the radio resource, etc., according to the cell handover preparation information upon deciding that the UE is allowed to be admitted, and sends a response message to the cell handover request to the macro eNB upon successful configuration.

[0121] Here the local eNB carries cell type information in the response message to the cell handover request to indicate that the destination cell supports a dynamic TDD UL/DL configuration.

[0122] The local eNB returns the response message to the cell handover request to the macro eNB as the cell handover command to trigger the cell handover of the UE, and the macro eNB sends the received cell handover command to the UE in an RRC connection reconfiguration message carrying the cell handover command, and stops data of the UE from being transmitted and received with the present eNB.

[0123] The UE knows from the cell handover command that the destination cell supports a dynamic TDD UL/DL configuration. In the subsequent cell handover procedure, the UE keeps on detecting a broadcast of the macro eNB to obtain the updated TDD configuration of the destination cell. If the UE knows that the TDD UL/DL configuration of the destination cell is changed, by fetching broadcast information of the destination cell in the cell handover procedure, then the UE will perform the cell handover procedure in the updated TDD UL/DL configuration of the destination cell at an instance of time when the TDD configuration change of the destination cell is validated.

[0124] For example, the destination cell is currently configured with the TDD UL/DL configuration 1, and after the destination eNB replies with the response message to the cell handover request, the TDD UL/DL configuration of the destination cell is changed to the configuration 3. The destination eNB notifies the UE in the response message to the cell handover request that the destination cell of cell handover is the type of cell supporting a dynamic TDD UL/DL configuration. The UE keeps on detecting a broadcast upon knowing from an RRC reconfiguration message carrying the cell handover command that the destination cell of cell handover is a cell supporting a dynamic TDD UL/DL configuration. If the UE knows that the TDD UL/DL configuration of the destination cell is changed to the configuration 3, by detecting the broadcast, then the UE transmits in the cell handover procedure in the TDD UL/DL configuration 3.

[0125] Based upon the same inventive idea as the method, an embodiment of the invention further provides a UE structured as illustrated in Fig.7, which includes:

An uplink transmission subframe determining unit 701 is configured to determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

[0126] A handover unit 702 is configured to send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0127] Preferably the uplink transmission subframe determining unit 701 is configured:

To obtain physical random access channel configuration information carried in the cell handover command;

[0128] To determine subframes for transmitting a physical random access channel according to the physical random access channel configuration information; and

[0129] To determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure.

[0130] Preferably the uplink transmission subframe determining unit 701 is configured:

[0131] To obtain subframe numbers for uplink transmission, carried in the cell handover command, and to determine subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

[0132] Preferably the uplink transmission subframe determining unit 701 is configured:

To obtain a time division duplex uplink-downlink configuration for the cell handover procedure, carried in the cell handover command, and to determine the subframes for uplink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command.

[0133] Preferably the handover unit 702 is further configured:

To determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command; and

[0134] To detect scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

[0135] Preferably the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the handover unit 702 is further configured:

To obtain subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and

To detect scheduling information sent by the access network device in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

[0136] Preferably the uplink transmission subframe determining unit 701 is configured:

To determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in the cell handover command.

[0137] Preferably the uplink transmission subframe determining unit 701 is further configured:

To search pre-contigmation information for the subframes for uplink transmission and with unchanged transmission directions; or

[0138] To obtain the subframes for uplink transmission and with unchanged transmission directions via higher-layer signaling.

[0139] Preferably during the handover to the destination cell, the handover unit 702 is further configured:

[0140] To start to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response, where the length of the random access response window is an integer greater than 10 ms.

[0141] Based upon the same inventive idea as the method, an embodiment of the invention further provides a second UE structured as illustrated in Fig.8. which includes a memory 703 and a processor 704, where:

The processor 704 is configured to execute a computer program, etc., for performing the method above at the UE side to thereby perform the functions at the UE side described in the embodiment of the invention; the memory 703 is configured to store codes of the computer program to configure the processor 704; and the processor 704 can include a baseband processing component, a radio frequency processing component, and other components, as needed, to transmit and receive data. The particular functions of the memory 703 and the processor 704 will be described below.

[0142] The processor 704 is configured to determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

[0143] The processor 704 is further configured to send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0144] Preferably the processor 704 is configured:

To obtain physical random access channel configuration information carried in the cell handover command;

[0145] To determine subframes for transmitting a physical random access channel according to the physical random access channel configuration information; and

[0146] To determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure.

[0147] Preferably the processor 704 is further configured:

To obtain subframe numbers for uplink transmission, carried in the cell handover command, and to determine subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

[0148] Preferably the processor 704 is further configured:

To obtain a time division duplex uplink-downlink configuration for the cell handover procedure, carried in the cell handover command, and to determine the subframes for uplink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command.

[0149] Preferably the processor 704 is further configured:

To determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command; and

[0150] To detect scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

[0151] Preferably the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the processor 704 is further configured:

To obtain subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and

To detect scheduling information sent by the access network device in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

[0152] Preferably the processor 704 is further configured:

To determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in the cell handover command.

[0153] Preferably the processor 704 is further configured:

To search pre-configuration information for the subframes for uplink transmission and with unchanged transmission directions; or

To obtain the subframes for uplink transmission and with unchanged transmission directions via higher-layer signaling.

[0154] Preferably during the handover to the destination cell, the processor 704 is Further configured:

To start to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response, where the length of the random access response window is an integer greater than 10 ms.

[0155] Based upon the same inventive idea as the method, an embodiment of the invention further provides a third UE structured as illustrated in Fig.9, which includes:

A broadcast detecting unit 801 is configured to detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

An uplink transmission subframe determining unit 802 is configured, if the broadcast detecting unit detects a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell, to determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

A handover unit 803 is configured to send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0156] Based upon the same inventive idea as the method, an embodiment of the invention further provides a fourth UE structured as illustrated in Fig.10. which includes a memory 804 and a processor 805, where:

The processor 805 is configured to execute a computer program, etc., for performing the method above at the UE

side to thereby perform the functions at the UE side described in the embodiment of the invention; the memory 804 is configured to store codes of the computer program to configure the processor 805; and the processor 805 can include a baseband processing component, a radio frequency processing component, and other components, as needed, to transmit and receive data. The particular functions of the memory 804 and the processor 805 will be described below.

[0157] The processor 805 is configured to detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

[0158] The processor 805 is further configured, if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the processor 805, to determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

[0159] A processor 805 is further configured to send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

[0160] Based upon the same inventive idea as the method, an embodiment of the invention provides an access network device structured as illustrated in Fig.11, which includes:

An uplink transmission subframe determining unit 901 is configured to determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

A handover command sending unit 902 is configured to send a cell handover command to the UE, where the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0161] Preferably the uplink transmission subframe determining unit 901 is configured:

To select subframes for transmitting a physical random access channel from subframes for uplink transmission and with unchanged transmission directions, and to determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure; and

[0162] Before the cell handover command is sent to the UE, the handover command sending unit 902 is further configured:

To generate physical random access channel configuration information corresponding to the subframes for transmitting a physical random access channel, where the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is the physical random access channel configuration information.

[0163] Preferably the uplink transmission subframe determining unit 901 is configured:

To determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure, where the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission; and

[0164] The access network device further includes a handover unit configured:

To receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0165] Preferably the access network device further includes a handover unit configured:

To send scheduling information to the UE in subframes corresponding to subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell.

[0166] Preferably the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a time division duplex uplink-downlink configuration in the cell handover procedure; and

[0167] Preferably the access network device further includes a handover unit configured:

To receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0168] Preferably the handover unit is further configured:

To determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration in the cell handover procedure; and
To send scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

[0169] Preferably the access network device further includes a configuration sending unit configured:

After a cell handover completion message sent by the UE is received, if a time division duplex uplink-downlink configuration of the destination cell is changed in the cell handover procedure, to send the changed time division duplex uplink-downlink configuration of the destination cell to the UE; and if the time division duplex uplink-downlink configuration of the destination cell is not changed in the cell handover procedure, to send the time division duplex uplink-downlink configuration of the destination cell, or indication information that the time division duplex uplink-downlink configuration is not changed to the UE; or
After a cell handover completion message sent by the UE is received, to send a time division duplex uplink-downlink configuration of the destination cell to the UE.

[0170] Preferably the access network device further includes a random access response sending unit configured:

To send a random access response message to the UE in a random access response window at a starting instance of time of a random access response, where the length of the random access response window is an integer greater than 10 ms.

[0171] Based upon the same inventive idea as the method, an embodiment of the invention provides a second access network device structured as illustrated in Fig. 12, which includes a memory 903 and a processor 904, where:

The processor 904 is configured to execute a computer program, etc., for performing the method above at the access network device to thereby perform the functions at the access network device described in the embodiment of the invention; the memory 903 is configured to store codes of the computer program to configure the processor 904; and the processor 904 can include a baseband processing component, a radio frequency processing component, and other components, as needed, to transmit and receive data. The particular functions of the memory 903 and the processor 904 will be described below.

[0172] The processor 904 is configured to determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

[0173] The processor 904 is further configured to send a cell handover command to the UE, where the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

[0174] Preferably the processor 904 is configured:

To select subframes for transmitting a physical random access channel from subframes for uplink transmission and with unchanged transmission directions, and to determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure; and

[0175] Before the cell handover command is sent to the UE, the processor 904 is further configured:

To generate physical random access channel configuration information corresponding to the subframes for transmitting a physical random access channel, where the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is the physical random access channel configuration information.

[0176] Preferably the processor 904 is further configured:

To determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure, where the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission; and

[0177] The processor 904 is further configured:

To receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0178] Preferably the processor 904 is further configured:

To send scheduling information to the UE in subframes corresponding to subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell.

[0179] Preferably the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a time division duplex uplink-downlink configuration in the cell handover procedure; and

[0180] The processor 904 is further configured:

To receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

[0181] Preferably the processor 904 is further configured:

To determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration in the cell handover procedure; and
To send scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

[0182] Preferably the processor 904 is further configured:

After a cell handover completion message sent by the UE is received, if a time division duplex uplink-downlink configuration of the destination cell is changed in the cell handover procedure, to send the changed time division duplex uplink-downlink configuration of the destination cell to the UE; and if the time division duplex uplink-downlink configuration of the destination cell is not changed in the cell handover procedure, to send the time division duplex uplink-downlink configuration of the destination cell, or indication information that the time division duplex uplink-downlink configuration is not changed to the UE; or
After a cell handover completion message sent by the UE is received, to send a time division duplex uplink-downlink configuration of the destination cell to the UE.

[0183] Preferably the processor 904 is further configured:

To send a random access response message to the UE in a random access response window at a starting instance of time of a random access response, where the length of the random access response window is an integer greater than 10 ms.

[0184] Based upon the same inventive idea as the method, an embodiment of the invention further provides a third access network device structured as illustrated in Fig.13, which includes:

A cell type determining unit 101 is configured to determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and
A handover command sending unit 102 is configured to send a cell handover command to a UE, where the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

[0185] Based upon the same inventive idea as the method, an embodiment of the invention further provides a fourth access network device structured as illustrated in Fig.14, which includes a memory 103 and a processor 104, where:

The processor 104 is configured with a computer program, etc., for performing the method above at the access network device to thereby perform the functions at the access network device described in the embodiment of the invention; the memory 103 is configured to store codes of the computer program to configure the processor 104; and the processor 104 can include a baseband processing component, a radio frequency processing component, and other components, as needed, to transmit and receive data. The particular functions of the memory 103 and the processor 104 will be described below.

[0186] The processor 104 is configured to determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and

[0187] The processor 104 is further configured to send a cell handover command to a UE, where the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

[0188] Those skilled in the art shall appreciate that the embodiments of the invention can be embodied as a method, a system or a computer program product. Therefore the invention can be embodied in the form of an all-hardware embodiment, an all-software embodiment or an embodiment of software and hardware in combination. Furthermore the invention can be embodied in the form of a computer program product embodied in one or more computer useable storage mediums (including but not limited to a disk memory, a CD-ROM, an optical memory, etc.) in which computer useable program codes are contained.

[0189] The invention has been described in a flow chart and/or a block diagram of the method, the device (system) and the computer program product according to the embodiments of the invention. It shall be appreciated that respective flows and/or blocks in the flow chart and/or the block diagram and combinations of the flows and/or the blocks in the flow chart and/or the block diagram can be embodied in computer program instructions. These computer program instructions can be loaded onto a general-purpose computer, a specific-purpose computer, an embedded processor or a processor of another programmable data processing device to produce a machine so that the instructions executed on the computer or the processor of the other programmable data processing device create means for performing the functions specified in the flow(s) of the flow chart and/or the block(s) of the block diagram.

[0190] These computer program instructions can also be stored into a computer readable memory capable of directing the computer or the other programmable data processing device to operate in a specific manner so that the instructions stored in the computer readable memory create an article of manufacture including instruction means which perform the functions specified in the flow(s) of the flow chart and/or the block(s) of the block diagram.

[0191] These computer program instructions can also be loaded onto the computer or the other programmable data processing device so that a series of operational steps are performed on the computer or the other programmable data processing device to create a computer implemented process so that the instructions executed on the computer or the other programmable device provide steps for performing the functions specified in the flow(s) of the flow chart and/or the block(s) of the block diagram.

[0192] Although the preferred embodiments of the invention have been described, those skilled in the art benefiting from the underlying inventive concept can make additional modifications and variations to these embodiments. Therefore the appended claims are intended to be construed as encompassing the preferred embodiments and all the modifications and variations coming into the scope of the invention.

[0193] Evidently those skilled in the art can make various modifications and variations to the invention without departing from the spirit and scope of the invention. Thus the invention is also intended to encompass these modifications and variations thereto so long as the modifications and variations come into the scope of the claims appended to the invention and their equivalents.

Claims

1. A method for cell handover, the method comprising:

determining, by a UE, subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and sending a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

2. The method according to claim 1, wherein determining, by the UE, the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device comprises:

obtaining, by the UE, physical random access channel configuration information carried in the cell handover command;
determining, by the UE, subframes for transmitting a physical random access channel according to the physical random access channel configuration information; and
determining, by the UE, the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure.

3. The method according to claim 1, wherein determining, by the UE, the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device comprises:

obtaining, by the UE, subframe numbers for uplink transmission, carried in the cell handover command, and determining subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

4. The method according to claim 1, wherein determining, by the UE, the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device comprises:

obtaining, by the UE, a time division duplex uplink-downlink configuration for the cell handover procedure, carried in the cell handover command, and determining the subframes for uplink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command.

5. The method according to claim 4, wherein the method further comprises:

determining, by the UE, subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command; and
detecting, by the UE, scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

6. The method according to any one of claims 1 to 5, wherein the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the method further comprises:

obtaining, by the UE, subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and
detecting, by the UE, scheduling information sent by the access network device in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

7. The method according to claim 1, wherein determining, by the UE, the subframes for uplink transmission in the cell handover procedure according to the instruction in the cell handover command sent by the access network device comprises:

determining, by the UE, subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in the cell handover command.

8. The method according to claim 7, wherein the method further comprises:

searching, by the UE, pre-configuration information for the subframes for uplink transmission and with unchanged transmission directions; or
obtaining, by the UE, the subframes for uplink transmission and with unchanged transmission directions via

higher-layer signaling.

9. The method according to any one of claims 1 to 5, 7 and 8, wherein during the handover to the destination cell, the method further comprises:

starting, by the UE, to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

10. A method for cell handover, the method comprising:

detecting, by a UE, a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;
if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the UE, then determining subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and
sending, by the UE, a message for a handover to the destination cell, to the access network device in the determined subframe during the handover to the destination cell.

11. A method for cell handover, the method comprising:

determining, by an access network device, subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframe for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and
sending, by the access network device, a cell handover command to the UE, wherein the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

12. The method according to claim 11, wherein determining, by the access network device, the subframes for uplink transmission in the cell handover procedure of the UE to the destination cell comprises:

selecting, by the access network device, subframes for transmitting a physical random access channel from subframes for uplink transmission and with unchanged transmission directions, and determining the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure; and
before the access network device sends the cell handover command to the UE, the method further comprises:

generating, by the access network device, physical random access channel configuration information corresponding to the subframe for transmitting a physical random access channel, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is the physical random access channel configuration information.

13. The method according to claim 11, wherein determining, by the access network device, the subframes for uplink transmission in the cell handover procedure of the UE to the destination cell comprises:

determining, by the access network device, subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission; and
the method further comprises:

receiving, by the access network device, a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

14. The method according to any one of claims 11 to 13, wherein the cell handover command further carries subframes numbers for downlink transmission in the cell handover procedure, and the method further comprises:

sending, by the access network device, scheduling information to the UE in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell.

15. The method according to claim 11, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a time division duplex uplink-downlink configuration in the cell handover procedure; and
the method further comprises:

receiving, by the access network device, a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission, determined according to the time division duplex uplink-downlink configuration in the cell handover procedure, during the handover of the UE to the destination cell.

16. The method according to claim 15, wherein the method further comprises:

determining, by the access network device, subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration in the cell handover procedure; and
sending, by the access network device, scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

17. The method according to any one of claims 11 to 13, 15 and 16, wherein the method further comprises:

after a cell handover completion message sent by the UE is received, if a time division duplex uplink-downlink configuration of the destination cell is changed in the cell handover procedure, then sending, by the access network device, the changed time division duplex uplink-downlink configuration of the destination cell to the UE; and if the time division duplex uplink-downlink configuration of the destination cell is not changed in the cell handover procedure, then sending, by the access network device, the time division duplex uplink-downlink configuration of the destination cell, or indication information that the time division duplex uplink-downlink configuration is not changed to the UE; or
after a cell handover completion message sent by the UE is received, sending, by the access network device, a time division duplex uplink-downlink configuration of the destination cell to the UE.

18. The method according to any one of claims 11 to 13, 15 and 16, wherein the method further comprises:

sending, by the access network device, a random access response message to the UE in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

19. A method for cell handover, the method comprising:

determining, by an access network device, that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and
sending, by the access network device, a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

20. A UE, comprising:

an uplink transmission subframe determining unit configured to determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and
a handover unit configured to send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

21. The UE according to claim 20, wherein the uplink transmission subframe determining unit is configured:

to obtain physical random access channel configuration information carried in the cell handover command;

to determine subframes for transmitting a physical random access channel according to the physical random access channel configuration information; and
to determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure.

22. The UE according to claim 20, wherein the uplink transmission subframe determining unit is configured:

to obtain subframe numbers for uplink transmission, carried in the cell handover command, and to determine subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

23. The UE according to claim 20, wherein the uplink transmission subframe determining unit is configured:

to obtain a time division duplex uplink-downlink configuration for the cell handover procedure, carried in the cell handover command, and to determine the subframes for uplink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command.

24. The UE according to claim 23, wherein the handover unit is Further configured:

to determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command; and
to detect scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

25. The UE according to any one of claims 20 to 24, wherein the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the handover unit is further configured:

to obtain subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and
to detect scheduling information sent by the access network device in subframes corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

26. The UE according to claim 20, wherein the uplink transmission subframe determining unit is configured:

to determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in the cell handover command.

27. The UE according to claim 26, wherein the uplink transmission subframe determining unit is further configured:

to search pre-configuration information for the subframes for uplink transmission and with unchanged transmission directions; or
to obtain the subframe for uplink transmission and with unchanged transmission directions via higher-layer signaling.

28. The UE according to any one of claims 20 to 24, 26 and 27, wherein during the handover to the destination cell, the handover unit is Further configured:

to start to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

29. A UE, comprising:

a broadcast detecting unit configured to detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;

an uplink transmission subframe determining unit configured, if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the broadcast detecting unit, to determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and

a handover unit configured to send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

30. An access network device, comprising:

an uplink transmission subframe determining unit configured to determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and

a handover command sending unit configured to send a cell handover command to the UE, wherein the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure.

31. The access network device according to claim 30, wherein the uplink transmission subframe determining unit is configured:

to select subframes for transmitting a physical random access channel from subframes for uplink transmission and with unchanged transmission directions, and to determine the subframe for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure; and

before the cell handover command is sent to the UE, the handover command sending unit is further configured:

to generate physical random access channel configuration information corresponding to the subframes for transmitting a physical random access channel, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is the physical random access channel configuration information.

32. The access network device according to claim 30, wherein the uplink transmission subframe determining unit is configured:

to determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission; and

the access network device further comprises a handover unit configured:

to receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

33. The access network device according to any one of claims 30 to 32, wherein the access network device further comprises a handover unit configured:

to send scheduling information to the UE in subframes corresponding to subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell.

34. The access network device according to claim 30, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a time division duplex uplink-downlink configuration in the cell handover procedure; and

the access network device further comprises a handover unit configured:

to receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission, determined according to the time division duplex uplink-downlink configuration in the cell handover procedure, during the handover of the UE to the destination cell.

35. The access network device according to claim 34, wherein the handover unit is further configured:

to determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration in the cell handover procedure; and
to send scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

36. The access network device according to any one of claims 30 to 32, 34 and 35, wherein the access network device further comprises a configuration sending unit configured:

after a cell handover completion message sent by the UE is received, if a time division duplex uplink-downlink configuration of the destination cell is changed in the cell handover procedure, to send the changed time division duplex uplink-downlink configuration of the destination cell to the UE; and if the time division duplex uplink-downlink configuration of the destination cell is not changed in the cell handover procedure, to send the time division duplex uplink-downlink configuration of the destination cell, or indication information that the time division duplex uplink-downlink configuration is not changed to the UE; or
after a cell handover completion message sent by the UE is received, to send a time division duplex uplink-downlink configuration of the destination cell to the UE.

37. The access network device according to any one of claims 30 to 32, 34 and 35, wherein the access network device further comprises a random access response sending unit configured:

to send a random access response message to the UE in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

38. An access network device, comprising:

a cell type determining unit configured to determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and
a handover command sending unit configured to send a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

39. A UE, comprising a memory and a processor, wherein the memory is configured to store codes of a computer program and the processor is configured to execute computer program to:

determine subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and
send a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell.

40. The UE according to claim 39, wherein the processor is configured:

to obtain physical random access channel configuration information carried in the cell handover command;
to determine subframes for transmitting a physical random access channel according to the physical random access channel configuration information; and
to determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure.

41. The UE according to claim 39, wherein the processor is configured:

to obtain subframe numbers for uplink transmission, carried in the cell handover command, and to determine subframes corresponding to the subframe numbers carried in the cell handover command as the subframes for uplink transmission in the cell handover procedure.

42. The UE according to claim 39, wherein the processor is configured:

to obtain a time division duplex uplink-downlink configuration for the cell handover procedure, carried in the cell

handover command, and to determine the subframes for uplink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command.

43. The UE according to claim 42, wherein the processor is further configured:

to determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration carried in the cell handover command; and
to detect scheduling information sent by the access network device in the subframes for downlink transmission during the handover to the destination cell.

44. The UE according to any one of claims 39 to 43, wherein the cell handover command further carries subframe numbers for downlink transmission in the cell handover procedure, and the processor is Further configured:

to obtain subframe numbers for downlink transmission in the cell handover procedure, carried in the cell handover command; and
to detect scheduling information sent by the access network device in subframe corresponding to the subframe numbers for downlink transmission in the cell handover procedure, during the handover to the destination cell.

45. The UE according to claim 39, wherein the processor is further configured:

to determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure upon determining that the destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in the cell handover command.

46. The UE according to claim 45, wherein the processor is further configured:

to search pre-configuration information for the subframes for uplink transmission and with unchanged transmission directions; or
to obtain the subframe for uplink transmission and with unchanged transmission directions via higher-layer signaling.

47. The UE according to any one of claims 39 to 43, 45 and 46, wherein during the handover to the destination cell, the processor is further configured:

to start to receive a random access response message sent by the access network device, in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

48. A UE, comprising a memory and a processor, wherein the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

detect a broadcast of an access network device upon determining that a destination cell supports a dynamic time division duplex uplink-downlink configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device;
if a broadcast carrying a changed time division duplex uplink-downlink configuration of the destination cell is detected by the processor, determine subframes for uplink transmission in a cell handover procedure according to the changed time division duplex uplink-downlink configuration; and
send a message for a handover to the destination cell, to the access network device in the determined subframes during the handover to the destination cell.

49. An access network device, comprising a memory and a processor, wherein the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

determine subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, wherein transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure; and
send a cell handover command to the UE, wherein the cell handover command carries information to instruct

the UE to determine the subframes for uplink transmission in the cell handover procedure.

50. The access network device according to claim 49, wherein the processor is configured:

to select subframes for transmitting a physical random access channel from subframes for uplink transmission and with unchanged transmission directions, and to determine the subframes for transmitting a physical random access channel as the subframes for uplink transmission in the cell handover procedure; and
before the cell handover command is sent to the UE, the processor is further configured:

to generate physical random access channel configuration information corresponding to the subframes for transmitting a physical random access channel, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is the physical random access channel configuration information.

51. The access network device according to claim 49, wherein the processor is further configured:

to determine subframes for uplink transmission and with unchanged transmission directions as the subframes for uplink transmission in the cell handover procedure, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is subframe numbers for uplink transmission; and
the processor is further configured:

to receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission during the handover of the UE to the destination cell.

52. The access network device according to any one of claims 49 to 51, wherein the processor is further configured:

to send scheduling information to the UE in subframes corresponding to subframe numbers for downlink transmission in the cell handover procedure, during the handover of the UE to the destination cell.

53. The access network device according to claim 49, wherein the information carried in the cell handover command to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure is a time division duplex uplink-downlink configuration in the cell handover procedure; and
the processor is further configured:

to receive a message, sent by the UE, for a handover to the destination cell in the subframes for uplink transmission, determined according to the time division duplex uplink-downlink configuration in the cell handover procedure, during the handover of the UE to the destination cell.

54. The access network device according to claim 53, wherein the processor is further configured:

to determine subframes for downlink transmission in the cell handover procedure according to the time division duplex uplink-downlink configuration in the cell handover procedure; and
to send scheduling information to the UE in the subframes for downlink transmission during the handover of the UE to the destination cell.

55. The access network device according to any one of claims 49 to 51, 53 and 54, wherein the processor is Further configured:

after a cell handover completion message sent by the UE is received, if a time division duplex uplink-downlink configuration of the destination cell is changed in the cell handover procedure, to send the changed time division duplex uplink-downlink configuration of the destination cell to the UE; and if the time division duplex uplink-downlink configuration of the destination cell is not changed in the cell handover procedure, to send the time division duplex uplink-downlink configuration of the destination cell, or indication information that the time division duplex uplink-downlink configuration is not changed to the UE; or
after a cell handover completion message sent by the UE is received, to send a time division duplex uplink-downlink configuration of the destination cell to the UE.

56. The access network device according to any one of claims 49 to 51, 53 and 54, wherein the processor is Further configured:

to send a random access response message to the UE in a random access response window at a starting instance of time of a random access response, wherein the length of the random access response window is an integer greater than 10 ms.

57. An access network device, comprising a memory and a processor, wherein the memory is configured to store codes of a computer program and the processor is configured to execute the computer program to:

determine that a destination cell supports a dynamic time division duplex uplink-downlink configuration; and send a cell handover command to a UE, wherein the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic time division duplex uplink-downlink configuration.

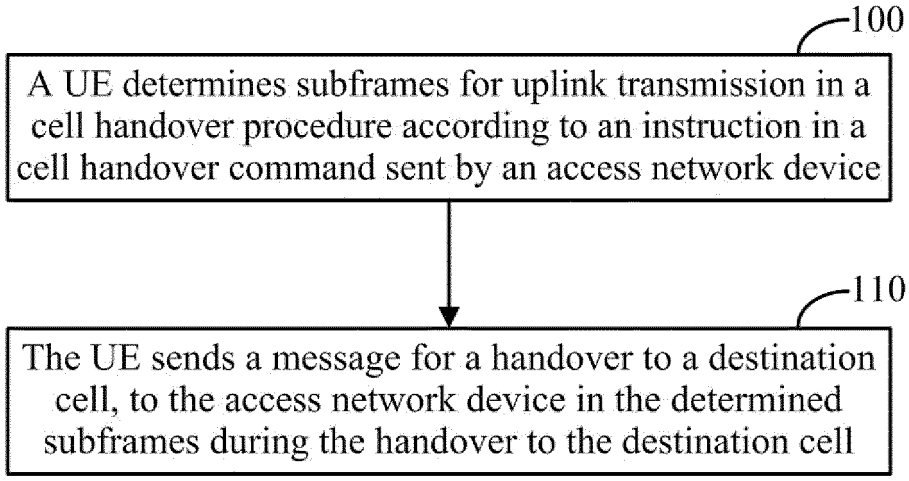
100
A UE determines subframes for uplink transmission in a cell handover procedure according to an instruction in a cell handover command sent by an access network device
110
The UE sends a message for a handover to a destination cell, to the access network device in the determined subframes during the handover to the destination cell

Fig.1

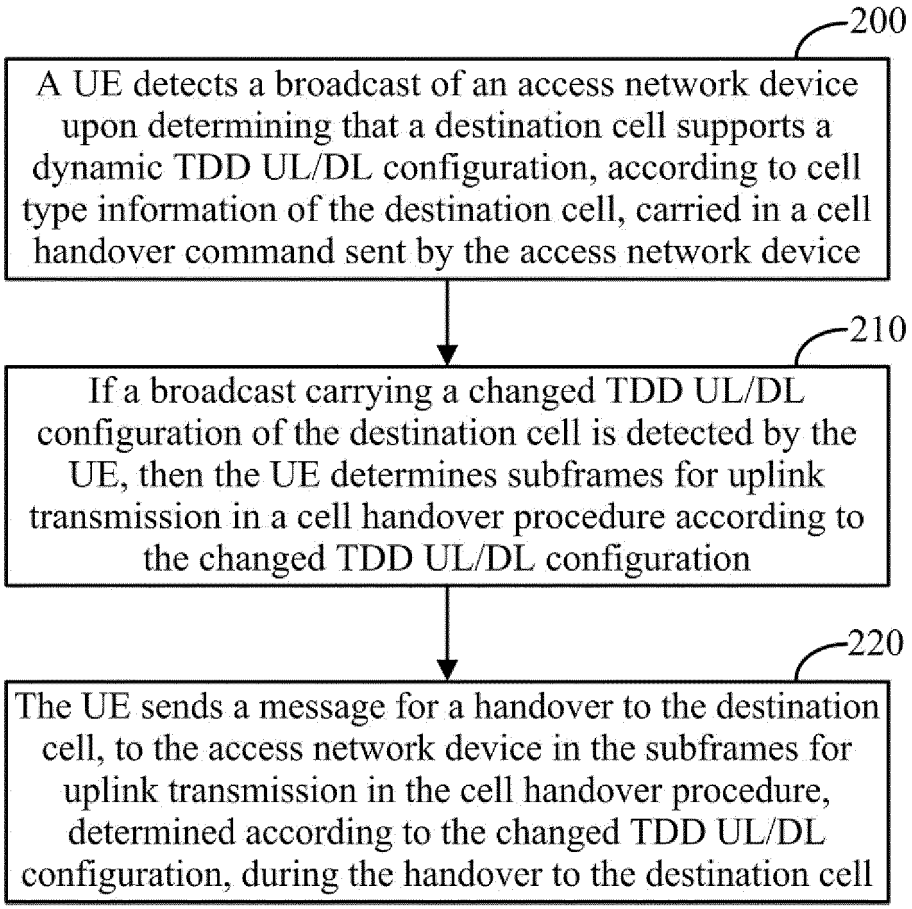
200
A UE detects a broadcast of an access network device upon determining that a destination cell supports a dynamic TDD UL/DL configuration, according to cell type information of the destination cell, carried in a cell handover command sent by the access network device
210
If a broadcast carrying a changed TDD UL/DL configuration of the destination cell is detected by the UE, then the UE determines subframes for uplink transmission in a cell handover procedure according to the changed TDD UL/DL configuration
220
The UE sends a message for a handover to the destination cell, to the access network device in the subframes for uplink transmission in the cell handover procedure, determined according to the changed TDD UL/DL configuration, during the handover to the destination cell

Fig.2

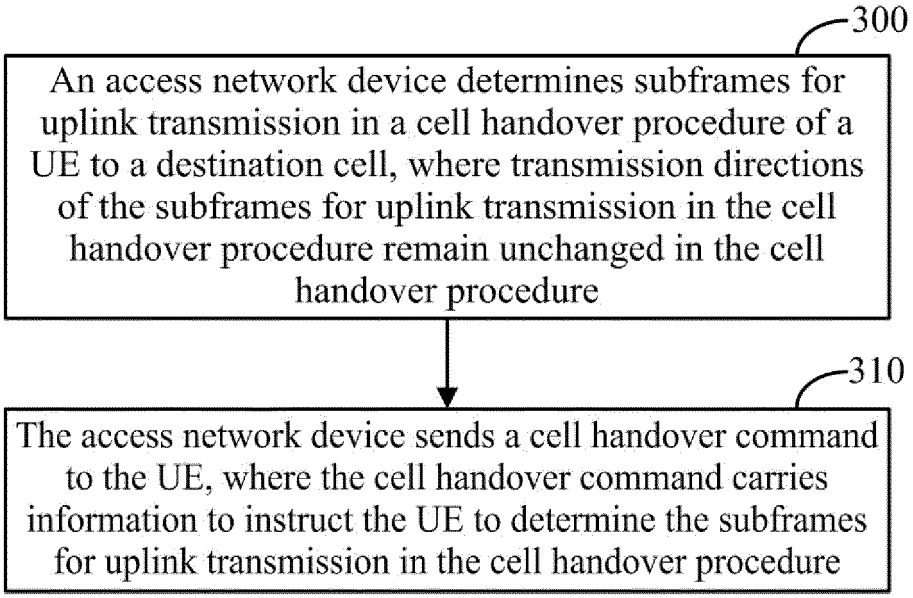
300
An access network device determines subframes for uplink transmission in a cell handover procedure of a UE to a destination cell, where transmission directions of the subframes for uplink transmission in the cell handover procedure remain unchanged in the cell handover procedure
310
The access network device sends a cell handover command to the UE, where the cell handover command carries information to instruct the UE to determine the subframes for uplink transmission in the cell handover procedure

Fig.3

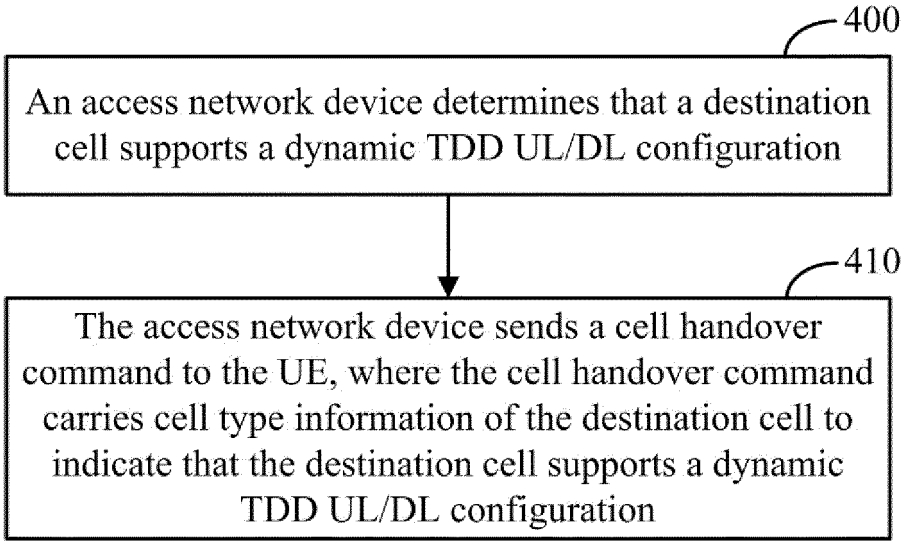
400
An access network device determines that a destination cell supports a dynamic TDD UL/DL configuration
410
The access network device sends a cell handover command to the UE, where the cell handover command carries cell type information of the destination cell to indicate that the destination cell supports a dynamic TDD UL/DL configuration

Fig.4

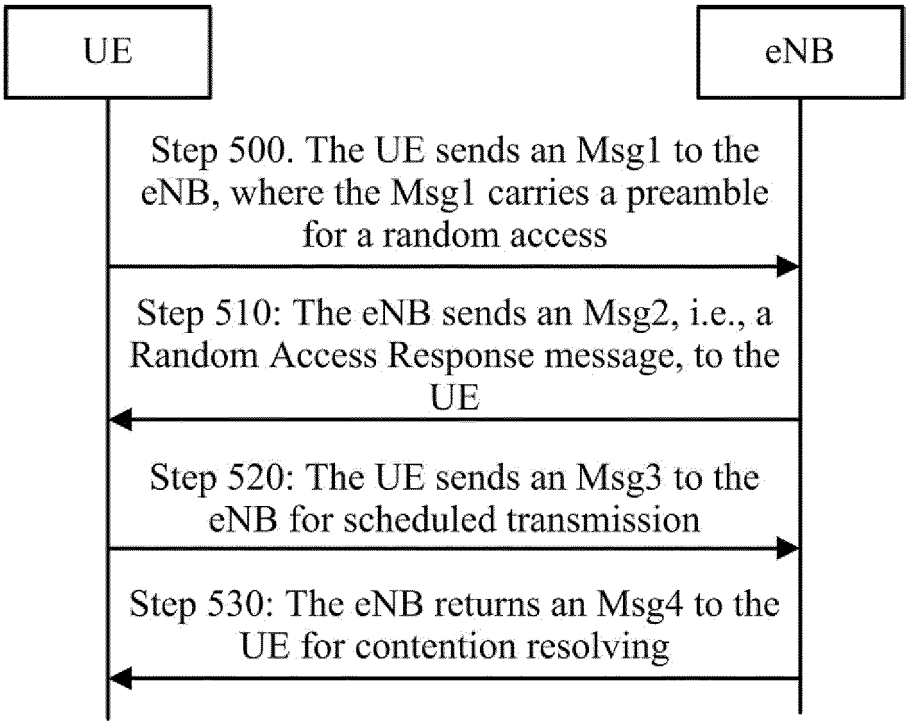
UE
eNB
Step 500. The UE sends an Msg1 to the eNB, where the Msg1 carries a preamble for a random access
Step 510: The eNB sends an Msg2, i.e., a Random Access Response message, to the UE
Step 520: The UE sends an Msg3 to the eNB for scheduled transmission
Step 530: The eNB returns an Msg4 to the UE for contention resolving

Fig.5

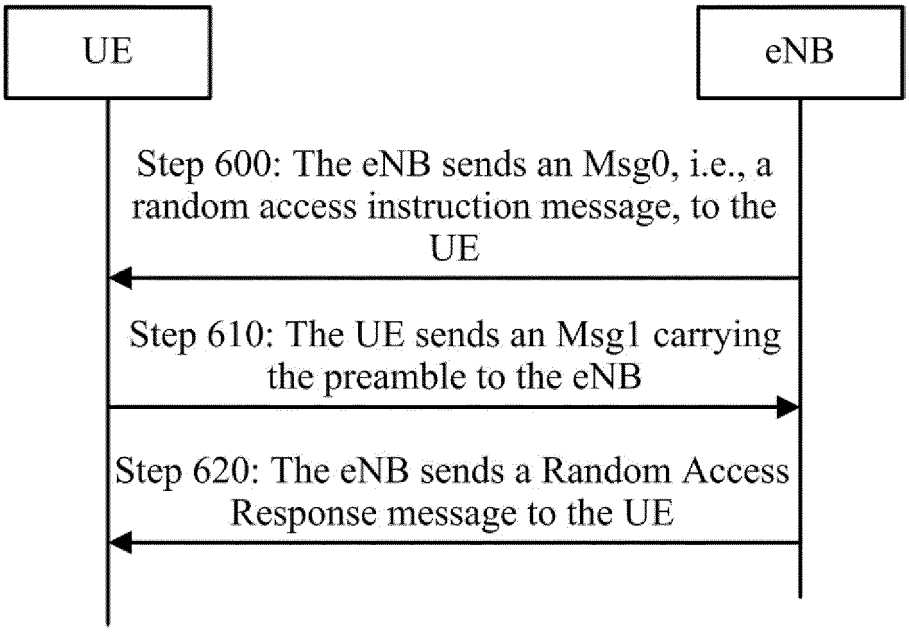
UE
eNB
Step 600: The eNB sends an Msg0, i.e., a random access instruction message, to the UE
Step 610: The UE sends an Msg1 carrying the preamble to the eNB
Step 620: The eNB sends a Random Access Response message to the UE

Fig.6

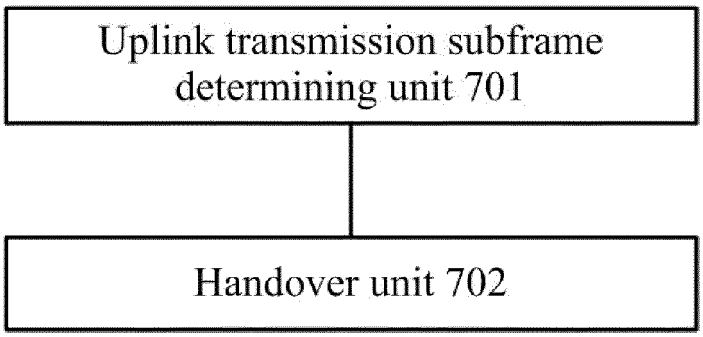

Fig.7

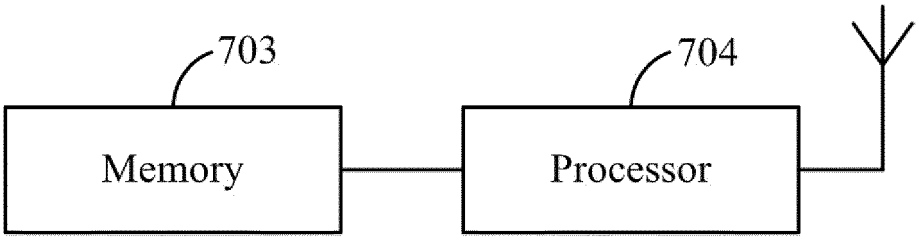

Fig.8

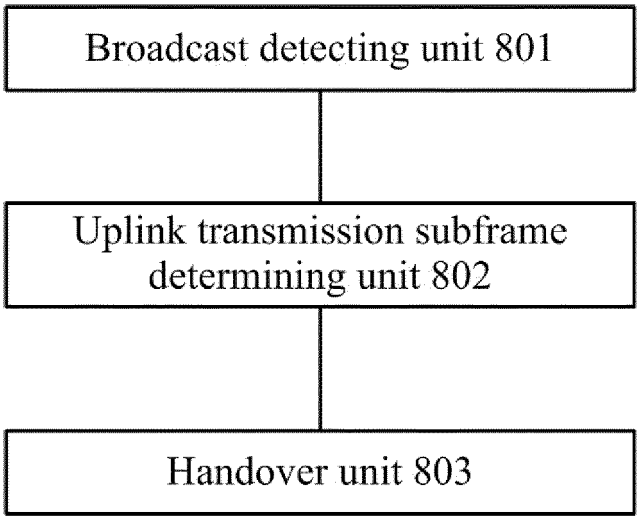

Fig.9

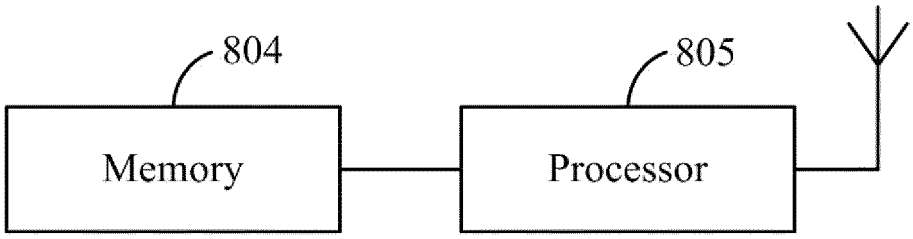

Fig.10

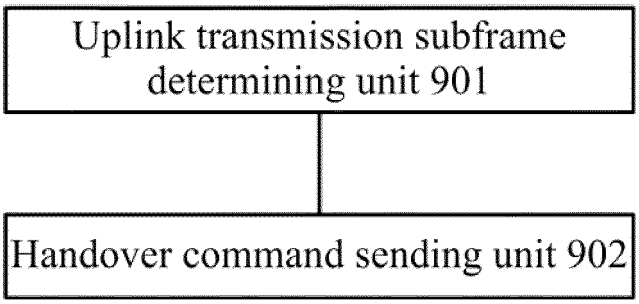

Fig.11

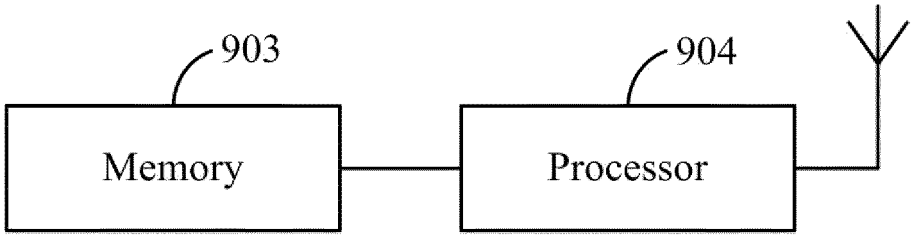

Fig.12

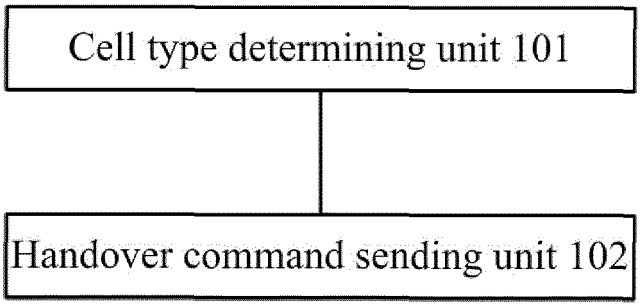
Cell type determining unit 101
Handover command sending unit 102

Fig.13

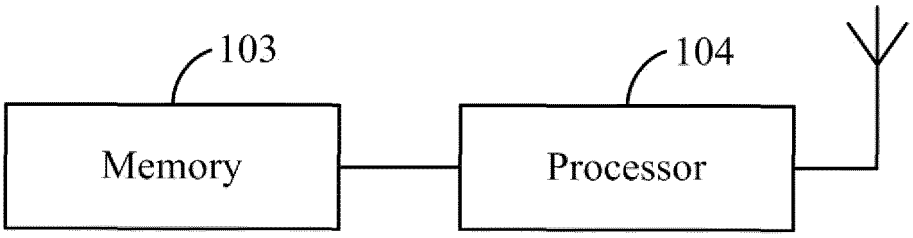
103
104
Memory
Processor

Fig.14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/074778

A. CLASSIFICATION OF SUBJECT MATTER

H04W 36/08 (2009.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W; H04Q; H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT; CNABS; VEN; DWPI; CNKI: cell, handover, hand w over, uplink, downlink, link, command, order, message, channel, pilot, frequency, BS, base, random, access, configure, configuration, number, sequence, frame, subframe, change, LTE, TDD, UL, DL, uppts

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 101998553 A (DATANG MOBILE COMMUNICATION EQUIP CO., LTD..) 30 March 2011 (30.03.2011) the whole document	1-57
A	CN 101932106 A (HUAWEI TECHNOLOGIES CO., LTD..) 29 December 2010 (29.12.2010) the whole document	1-57
A	CN 101882985 A (ZTE CORP.) 10 November 2010 (10.11.2010) the whole document	1-57
A	CN 102958119 A (HTC CORP.) 06 March 2013 (06.03.2013) the whole document	1-57

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 July 2014	14 July 2014
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer YANG, Hao Telephone No. (86-10)62411449

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/074778

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101998553 A	30 March 2011	CN 101998553 B	31 July 2013
CN 101932106 A	29 December 2010	WO 2011147363 A1	01 December 2011
CN 101882985 A	10 November 2010	WO 2010127624 A1	11 November 2010
CN 102958119 A	06 March 2013	US 2013039257 A1	14 February 2013
		TW 201309058 A	16 February 2013

Form PCT/ISA /210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201310118038 **[0001]**